Aditya Saraf

3501 217th Place SE, Bothell, WA 98021
sarafa@cs.washington.edu | (425) 697 – 0256

RESEARCH INTERESTS

Behavioral Economics, Algorithmic Game Theory, Matching Markets, Differential Privacy, Complexity Theory

EDUCATION

UNIVERSITY OF WASHINGTON, Seattle, WA — Expected June 2020
Master of Science in Computer Science – Anticipated Spring 2020

UNIVERSITY OF WASHINGTON, Seattle, WA — June 2019
Bachelor of Science in Computer Engineering, Magna cum laude, GPA: 3.9

- Minor: Philosophy
- Phi Beta Kappa (ΦBK) member

RESEARCH EXPERIENCE

TIME-INCONSISTENCY IN COMPETITIVE PLANNING PROBLEMS — December 2019–current
With Anna Karlin and Jamie Morgenstern (UW)

- Analyzed a model of present bias (i.e. procrastination) in graph-based planning problems introduced by Jon Kleinberg. Existing work shows that present bias can result in exponentially higher cost compared to optimal behavior
- Added competition between multiple biased agents to the model; we aim to show that competition alleviates some of the harms of present bias, and can naturally guide agents towards optimal behavior
- Canonical applications include businesses competing to get to market first, incentivizing students to complete assignments, incentivizing customers to join and use gym facilities, etc.

DISTRIBUTED PRIVACY FOR CORRELATED DATA — October 2019–current
With Grant Schoenebeck (UMich) and Jie Gao (Rutgers)

- Work with a recent generalization of differential privacy called Bayesian differential privacy, which protects against a wider class of adversaries than standard differential privacy
- Analyze highly correlated data sets, such as data generated from Markov Chains or Markov Random Fields, where traditional differential privacy falls short
- Create sanitized datasets for offline analysis, to enable "local" privacy that works even in distributed settings

QUALITATIVE PROBABILITY FOR STATISTICAL PRINCIPLES — January 2019–current
With Conor Mayo-Wilson (UW)

- Work within a formal system of qualitative conditional probability to prove statistical principles
- Show that Bayesian defenses (of algorithms, statistical principles, etc.) apply even when agents might lack quantitative degrees of belief.
- Presented our initial findings at FEW (Formal Epistemology Workshop) 2019.
- Build programs to test the impact of "incoherent" (i.e. non-probabilistic) priors on learning parameters through data

MODELING ALTRUISM IN DYNAMIC KIDNEY EXCHANGES — September 2018–March 2019
With John Dickerson (UMD)

- We use dynamic matching markets to model kidney exchanges, quantifying the increase in productivity from altruistic donors. We aim to both prove theoretical bounds and propose practical policies.
- Model the effect of a "kidney voucher" system proposed by the National Kidney Registry to encourage donations

COMPLEXITY OF HIDDEN GRAPH PROPERTIES — June 2018–current (revisions ongoing)
With Aarthi Sundaram (UMD)

- Wrote a paper that describes new classifications schemes for monotone graph properties and hidden graph problems (see Significant Papers)
- Analyzed the relative complexity of various classes of hidden graph properties and developed a transfer theorem from graph properties in the hidden setting to constraint satisfaction problems in the standard setting

TECH POLICY LAB — September 2016–June 2017
With Emily McReynolds (UW)

- Researched privacy and security concerns around upcoming technologies in the fields of autonomous vehicles, the Internet of Things, and cell-site simulators
- Co-authored "Toys that Listen: A Study of Parents, Children, and Internet-Connected Toys", published in CHI'17

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TEACHING EXPERIENCE

CSE 311**: FOUNDATIONS OF COMPUTING I,** UW, Instructors: Kevin Zatloukal, Emina Torlak September–December 2018
The first class in the major, teaching the basics of logic, discrete math, and formal languages.

CSE 421: **INTRODUCTION TO ALGORITHMS,** UW, Instructors: Various Spring '18, Winter '19, Spring '19
An upper division algorithms class taught primarily to juniors/seniors.

CSE 490C: **CRYPTOGRAPHY,** UW, Instructor: Huijia (Rachel) Lin September 2019–December 2019
An upper division class on formal cryptography.

CSE 590/490Z: **INCENTIVES IN COMPUTER SCIENCE,** UW, Instructor: Anna Karlin January 2020–June 2020
A class for master's students and advanced undergraduates that surveys topics between economics and computation.

INDUSTRY EXPERIENCE

AMAZON, Seattle, WA June 2017–September 2017
Exports and Expansion Technology – Customer Experience

Software Development Engineer Intern

- Created a full stack application with Spring MVC (Java), including a web-based frontend server and a RESTful backend service.
- Had end-to-end ownership – discovered (internal) customer requirements; planned and designed the application; developed, tested and deployed the application to production.
- Reduced deployment cycle from 2-4 weeks to instant changes to production.

SIGNIFICANT PROJECTS

SINGLE DOCUMENT SUMMARIZATION **LANGUAGE: PYTHON**

- Implemented state of the art neural document summarizers from recent literature
- Developed combinatorial summarizers that used SAT or ILP solvers
- Built a web-based visualizer to easily compare the summaries generated by different models
- Performed several scientific experiences to compare neural and combinatorial approaches

SYNCHRONIZED DOCUMENT EDITING **LANGUAGE: JAVA**

- Built a robust, client-server application that allowed multiple users to collaborate on one document in real time
- Implemented Differential Synchronization, a design paradigm that constantly cycles diffs and patches to resolve conflicts and converge to a consistent document
- Gained significant experience working with highly concurrent network applications

SIGNIFICANT PAPERS

1. Emily McReynolds, Sarah Hubbard, Timothy Lau, **Aditya Saraf**, Maya Cakmak, and Franziska Roesner. 2017. *Toys that Listen: A Study of Parents, Children, and Internet-Connected Toys.* In Proceedings of the 2017 CHI Conference on Human Factors in Computing Systems (CHI '17). ACM, New York, NY, USA, 5197-5207.
   In this paper, we explore how parents feel about purchasing internet connected toys for their children. We published this time during my time at the Tech Policy Lab.
2. **Aditya Saraf**, Tommy Schneider, Aarthi Sundaram. *Trial and Error for Graph Properties*. Working Draft.
   This work draws connections between hidden constraint satisfaction problems and monotone graph properties, characterizing which graph properties are tractable with access to a particular oracle.
3. Conor Mayo-Wilson, **Aditya Saraf**, *Qualitative Likelihoodism*. Working Draft.
   We first formulate qualitative analogs of two likelihoodist theses: LP and the law of likelihood (LL). Then, using a framework for qualitative conditional probability, we prove three novel theorems that suggest that the qualitative analogs of LP and LL motivate – and are best motivated by – qualitative forms of Bayesian reasoning.
4. Conor Mayo-Wilson, **Aditya Saraf**. *New Foundations for Bayesian Statistics*. In review for the Philosophy of Science Association 2020
   This is a more philosophical work that identifies weaknesses in the traditional foundations of Bayesian Statistics, and suggests